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Mathematics Achievement of Vietnamese Grade 5 Pupils

Patrick Griffin
The University of Melbourne
Australia

This article reports the results of a national survey of mathematics achievement at the end of primary school in Vietnam. A sample of more than 72000 students were assessed from 61 provinces. The items were matched to the Vietnam Mathematics curriculum for Year 5 students. Using a skills audit of the items, a variable of Vietnamese mathematics development was defined following an item response analysis of the data. Findings reveal that the levels of mathematics achievement were relatively high and that the mathematics curriculum was closely aligned with international trends in mathematics for primary school. There were some areas of concern in that lower achievement levels were persistently aligned with low socio economic groups and these were typically located in three regions of Vietnam, heavily populated by ethnic sub-groups.

Key words: mathematics achievement, Rasch model, competency, numeracy, systems, national testing

The availability of information on education in Vietnam increased during the last decade of the 20^{th} century. Following a UNESCO sector report in the early 1990s, the "Vietnam Education Financing Sector Study" was jointly conducted in 1996 by the Government of Vietnam and the World Bank. That study examined the costs and financing of the education and training system, and addressed issues such as the cost of education, who pays for it, and value added analyses, but it did not analyse the content and the quality of education, nor attempt to define the outcomes of the education system in terms of learning and student achievement.

In any system of education, probably the most important aspect is "whether or not the pupils are learning", or "to what extent the pupils have learned what they were meant to learn". In this paper, a proxy measure for learning has been examined - the pupils' achievement measured towards the end of their time in Grade 5. This is, in a way, the culmination of learning that has taken place up to the end of primary education in Vietnam.

At the beginning of the school year 2001-02, Vietnam had, for all intents and purposes, achieved its target of universal primary education and was moving to address the more difficult issue of enrolling the last few children from remote areas and disadvantaged circumstances (<10% of the 6-10 age cohort). At the same time, the Government was expanding secondary education and universalising lower secondary education. The population census in 1999 showed that the primary-school-age population had stabilised and was expected to decline early in the next decade. This decline in demographic pressure, coupled with the projected growth in GDP and some increase in public spending on education during the same period, was expected, for the first time ever, to allow Vietnam to shift its focus from increasing the quantity of primary schooling to improving the quality of mass basic education. However, to make the switch from quantity to quality, an understanding of the current determinants of the quality of primary education in Vietnam was needed.

As part of the ongoing primary education development project, the Government conducted a limited study of pupil achievement at grade 3 and grade 5 in a small sample of schools in five out of 61 provinces of Vietnam. The results showed that there were large disparities in learning

Patrick Griffin, Assessment Research Centre, The University of Melbourne, Australia.

The views expressed in this paper are those of the authors and do not claim to represent the views of the Vietnamese Government in any way. The article is based on a World Bank project (in Vietnam) on achievement at the end of primary school.

Correspondence concerning this article should be addressed to Professor Patrick Griffin, Faculty of Education, The University of Melbourne, Parkville Australia 3010.e-mail: p.griffin@unimelb.edu.au

achievement both between provinces and between schools within provinces (Griffin, 1998, 1999). Pupils from grade 3 in Hanoi had levels of achievement in mathematics and Vietnamese that were higher than pupils from grade 5 in the other four provinces. Given the small size of the sample, it was not possible to generalize from these results to all the provinces. Nevertheless, these few facts suggested that the primary school system was not yet capable of providing high quality and equitable learning outcomes to all of its pupils (Griffin, 1998).

In order to increase its competitiveness, the Vietnam government was looking for ways to improve the quality of its education system and lay the foundation for a more active learning approach that would be better suited to the demands of globalization, continual rapid change and a market-based economic system. The Government, through the Ministry of Education and Training (MOET) and its provincial education offices, launched education reforms on various fronts. From 2002 onwards, new curricula and textbooks for primary schools were introduced. The general thrust of the curriculum reform was to modernize the content and methods of teaching to promote a more dynamic, flexible approach to learning. This new approach to learning was expected to lay the foundation for a society in which basic skills in numeracy and literacy are central.

One task was to equalize learning opportunities for every child in primary school and to prepare him or her to move on to higher levels of education. To start on this process, the MOET sought a "picture" of key learning outcomes in the last grade of mass education (grade 5) before such major reforms took place.

At the time of the study, just over two thirds of those who entered primary schools completed the full cycle of five years. Similar studies from other countries indicate that adults with less than complete primary education remain functionally illiterate and non-numerate for the rest of their lives (Coleman, 1994). For this reason, the proportion of children who did not complete primary school education was a matter of some concern. Levels of functional literacy, identified in the 5-province study among the year 5 students, supported these projections.

In Barro's (2001) analysis of the links between education quantity (increases in the average years of schooling of the population) and education quality (increases in the average student performance on international assessments) and the growth rate of real per capita GDP, he found that an additional year of schooling was associated with 0.44% per year higher economic growth, but that a one-standard-deviation increase in science scores boosted the growth rate by 1% a year. He concluded that both quantity and quality of education matter, but that quality mattered more.

The purpose of the present study was to conduct the first major review of education quality and learning outcomes of Vietnamese primary education. This was done by measuring and analysing Vietnamese grade 5 student performance in mathematics and linking these to family and school factors to better understand the current levels and determinants of educational quality. Moreover, the links between family and school achievement were also examined to see whether socioeconomic factors were also affecting achievement (as suggested by Coleman, 1994). The paper reports on the following objectives of the overall study and focuses on mathematics achievement. The objectives were:

1. To provide a nationally and provincially representative *baseline* of educational quality.
2. To provide a basis to establish *minimum learning performance standards* for all children and to help education managers to move from a concept of equity defined in terms of resource inputs to a revised concept of equity in terms of educational outcomes.
3. To identify groups of pupils, schools and provinces where the achievement levels are unacceptably low and to examine the reasons for low achievement (*educationally disadvantaged groups*).

The sample design was selected to meet the standards set down by the International Association for the Evaluation of Educational Achievement (IEA). It provided a nationally and provincially representative estimate of all surveyed indicators. A detailed explanation of the sampling method is provided by Ross, Saito, Dolata, and Ikeda (2005).

Test instruments to measure student learning outcomes were designed and prepared by Vietnamese curriculum and testing specialists with international technical assistance, following the specifications described in the report by Postlethwaite (2005). These were based upon the pattern set out by Griffin (1999) adopted in the earlier five province study in which the variable to be measured was hypothesized in advance through test specifications and then examined empirically (Messick, Beaton, & Lord, 1983). National specialists prepared and trialed test items that were based on the current primary education curriculum using Bloom's (1956) taxonomy of educational objectives as an organizing principle. Test items for mathematics focused on measurement, number and space/data. Permission was sought and granted from UNESCO/IIEP to use some test items from the SACMEQ

(Murimba et al., 2002) studies of student achievement ongoing in sub-Saharan Africa. All tests were calibrated using item response modeling (Adams & Khoo, 1995; Andrich, 2002; Lord, 1980; Wu, Adams, & Wilson, 1998).

The test specifications ensured that the test items measured both the old and new curricula. In Vietnamese mathematics education, the emphasis was on a local curriculum, which was linked to international approaches to mathematics teaching and learning. International curriculum trends and assessment methods influenced the Vietnamese curriculum, and it had much that is common with most other countries. Performance testing with problem solving, however, could not be done with such a large sample and the performance testing techniques that the assessment of problem solving processes would require.

Other aspects of testing and of changes in curriculum were also taken into account. For example, the objectives of the mathematics curriculum placed an emphasis on rote learning and not on information processing or inference. This is changing in the curriculum currently being introduced to primary schools but this process of reform was not far advanced at the time of this study.

Three different methods of reporting the achievement levels were used because they each provided different uses and interpretation of the data. These are reported in detail below. The first described the skill development of the pupil. The second indicated how the pupil has been prepared to cope with the mathematics demands of two contexts into which the pupil might progress: the Vietnamese community and lower secondary education. The third was a scaled score used to analyse and interpret differences in performances between groups. The details of how each of the measures was developed are provided in Volume 3 of Postlethwaite (2005).

Skill Levels

Six skill levels were identified in mathematics (see Table 1). The levels were hierarchical and it was possible to calculate the percentages of pupils who had or had not reached each of the skill levels. These skill levels enabled a direct interpretation of the pupils' performances in each of the tests and to link the skills to possible intervention through curriculum development and teaching strategies. They provided a criterion-referenced and developmental framework for interpreting how pupils were progressing and what they could and could not do in terms of increasing levels of competence. Details of how these levels were defined are explained by Griffin (2005). The skill levels were based on previous work and approaches to profile reporting (Griffin, 1990; Griffin, Smith, & Ridge, 2001; Wilson, 1999). This and the benchmark approach, below, followed the criterion-referenced approach to reporting and interpreting achievement (Glaser, 1963, 1981, 1990). It also followed the approach used by the World Bank in national studies in developing countries (Greaney, Khandker, & Alam 1999).

Benchmarks

Two benchmark levels[1] were also established. They were based on the pupil's ability to cope with mathematics tasks encountered in specific circumstances. The first benchmark was based on a pupil's ability to use a set of mathematics skills needed to function at a basic level in Vietnamese society. Those below this benchmark were described as *pre-functional*. A second benchmark was based on an estimation of a pupil's ability to cope with the mathematics tasks in the next grade of education, grade 6, which is the first year of secondary education in Vietnam. The two benchmarks helped to identify three groups of pupils. Those below the first benchmark would need considerable help to enable them to function and participate fully in Vietnamese society. Those above this benchmark but below the second would need assistance to help them cope with the mathematics involved in secondary education. Pupils above the second benchmark were expected to be able to cope with the mathematics involved in secondary education. This is explained more fully below:

Benchmark 1

A group of pupils were described as *pre-functional* because they had not yet reached a benchmark demonstrating the mathematics skills required for everyday activities in Vietnamese society. This did not mean that the pupils were non-numerate. There were basic skills that these pupils could demonstrate, but the skill level was not deemed by Vietnamese experts to be at a sufficient level to enable the person to be an effective member of Vietnamese society.

A second group of pupils was identified as those who could demonstrate the kinds of skills needed to cope with life in Vietnam. They were above the lower benchmark but had not yet reached the second benchmark. These pupils were designated as *functional* in terms of their capacity to participate in Vietnamese society but it was considered that they would need some remedial assistance to be able to cope with the mathematics required at grade 6 and higher grade levels of secondary education.

Table 1

Table 2

Table 3

Table 4

Benchmark 2

These pupils, whose performances were above the second benchmark, were described as demonstrating the kinds of skills that were desirable in order to learn independently at the next level of schooling, without depending on remedial assistance. The label used in the tables to describe these pupils was *independent*.

Total Scores and Sub-Scores

Pupils' scores on each test and sub-domain of items were converted to a neutral, common scale allowing estimates of relative educational importance of differences between groups. A scale with a mean of 500 and a standard deviation of 100 was developed. This is a frequently used conversion of scores. The scaled score was used to examine differences between sub-groups in the sample. In educational research, differences of 0.2 standard deviations are often considered to be large and educationally important. With very large samples, such as we have in this study, very small differences could appear to be statistically significant and this statistical significance has often been mistaken for educational importance. Using the scale with a mean of 500 and a standard deviation of 100 gives a simple way of interpreting differences. Differences between groups of more than 20 points deserve to be examined in detail for possible explanation, as they may be of some educational importance.

Skill Levels in Mathematics

All score outcomes and methods of reporting were examined at the national, regional and the provincial level, as well as by school isolation. The skills levels were derived by a skills audit of items sorted in order of increasing difficulty. A detailed explanation of this is provided by Griffin (2005) and, for clarity, the skill levels are described in Table 1.

At the National Level

From Table 1, it can be seen that, at the national level, pupils in Vietnam demonstrated quite high levels of skills in mathematics but that there were still some pupils with low levels of achievement in mathematics (Levels 1 and 2).

The mathematics test included items from the old and new curricula that were related to secondary schooling, but not currently included in the primary school curriculum. For instance, the objectives of the old mathematics curriculum placed emphasis on drill and rote processes and not on information processing and inference development. While this was changing in the new curriculum, the development of teachers and pupils had not yet reached the levels that would be expected to lead to higher levels of achievement. There were many issues that still needed to be dealt with in the Vietnamese mathematics curriculum in the transition to the new curriculum.

At the Regional Level

The percentages of pupils who reached the various levels of skills in mathematics are presented in Table 2. It can be seen that there were large differences between regions in terms of achievement of levels of skills. The Mekong Delta had only 13% of pupils at the highest level measured by the test of mathematics skill. In contrast, the Red River Delta had 38% of pupils at this level. At the lower levels of mathematics skills, especially Levels 1 and 2, the Mekong Delta had a total of 6% of pupils compared with the Red River Delta's 2.1% of pupils. It is clear that there were important regional differences in terms of achievement of pupils.

By School Location

School location was coded as *isolated*, *rural*, or *urban*. From Table 3 it can be seen that most pupils at Level 1 were to be found in the isolated areas and that most pupils at Level 6 were to be found in the urban areas. In the Mekong Delta, as well as in the North West, North East, Central Coast, and the Central Highlands, there were unacceptably high proportions of pupils at Levels 1 and 2 in isolated schools.

Benchmarking

In addition to the distribution of skills within school location and region, it was instructive to examine how well pupils were prepared at the end of primary school to enter the community as independent citizens or to begin their lower secondary education as independent learners. It was also important to see how well this was achieved in different regions and provinces in Vietnam.

In order to do this, the benchmark performances were also examined at the national, regional and provincial levels as well as by school location. About 20% of pupils were identified as not reaching the second benchmark (where they

could be described as having the mathematics skills to enable independent learning in Grade 6). Less than 40% of pupils in isolated areas in the North East, North West, Central Coast, Central Highlands, and South East regions, and in isolated and rural areas in the Mekong Delta were identified as having independent learning skills. Less than 30% of pupils in provinces in the Mekong Delta such as Kien Giang, Tra Vinh, Soc Trang, and Bac Lieu had reached the level of independence in mathematics. Again, these are isolated areas, while the areas where higher proportions of pupils are prepared for independent learning in secondary school were largely concentrated in highly industrialised, modern locations in Vietnam.

At the Regional Level

The differences between regions in terms of pupil benchmark levels in mathematics are presented in Table 4.

As previously discussed, the definition of *functional* used in this study was *"the level of mathematics ability needed to function effectively in Vietnamese society"*. This did not mean that people who had not reached a functional level of mathematics skill were non-numerate! The members of the expert panels who worked on these definitions took into account the school curriculum, performances on the test and the types of mathematics that were assessed in the Grade 5 tests. These were compared to the kinds of mathematics that a citizen would need to be able to do in Vietnam to function in the community. A score was then set, using the Angoff (1977) procedure, which separated those considered to be functional from those who were judged to be at a pre-functional level and who would be expected to struggle in numeracy tasks required on a day-to-day basis.

From Table 5 it can be seen how the Angoff procedure, applied to the items representing the two parts of the test, yielded percentage scores for the two benchmarks. The expectations in terms of the benchmarks did not change. Accordingly, in the remainder of this paper the full test result has been used for reporting purposes.

In the Mekong Delta region and in the North East and North West, 4 to 8% of the pupils were assessed as *pre-functional* in mathematics and the situation for promotion to lower- secondary school was serious. In the Mekong Delta, 67% of pupils were categorised as reaching the independent learning benchmark.

By the end of primary school it could be reasonably expected that all pupils would have sufficient mathematics skills to engage in everyday activities of the Vietnamese community. It could also be expected that at least 95% of pupils would have reached the level of competence at which they could be expected to learn independently in lower secondary school. Indeed, this figure was set as the target for school principals.

At the Provincial Level

There were differences between regions in achievement and there were also large differences between provinces. Even within the highest performing region, there was considerable variation between provinces. The situation was of particular concern in the Mekong Delta region where overall performance levels tended to be low. In this region, pre-functional rates rose to more than 20% in a number of provinces and the proportion of pupils with independent learning skills for lower secondary school was low across all provinces in the region.

There was a wide range of variation in the extent to which pupils were prepared to enter the community or to enter secondary education. As with the competency levels, the benchmark data illustrated that there were several provinces where pupils had not attained a level that allows them to enter society with mathematics skills needed by independent citizens. Once again, these are concentrated in the same regions in the North West, North East, Central Highlands and in the Mekong Delta. It is evident that, in these regions, the capacity of people to participate in the community and to make informed decisions must be limited if the level of numeracy skills remains so low at the end of primary school.

Table 5

In general, the situation in terms of mathematics skill levels of students at the end of primary education in Vietnam is apparently quite positive. Approximately 80% of pupils were categorised as being of such a level in math as to be able to cope independently in Grade 6 and more than 97% had functional numeracy levels. In general, it appeared that the overall levels of mathematics achievement were acceptable in contrast to the literacy levels as reported by Postlethwaite (2005).

By School Location

It is clear that isolation was related to achievement - and an examination of other factors that arise from isolation and are, in turn, related to achievement have been examined by Postlethwaite (2005). In every region, the pupils in isolated schools had the lowest performance levels. Isolated schools also had lower percentages of pupils with the mathematics skills needed for independent learning in secondary school. In the isolated locations of some regions (notably the North West, Central Highlands and Mekong Delta regions) this was especially noticeable.

The relationship between school location and achievement is presented in Figure 1. There was a clear relationship between isolation and pre-functional skill levels in mathematics. There was also a clear relationship between urban areas and the chance of having higher mathematics skills before entering secondary education. However, functionality was defined by specialists in an urban context and the classification may need to be interpreted with this in mind. It is possible that mathematics demands differ in different contexts, but the overall lack of skills should still be regarded with concern. The overall situation in Vietnam in mathematics, however, does not raise cause for alarm.

Test Scores in Mathematics

The first two methods of reporting achievement have demonstrated that there were differences in the distribution of skills within and between provinces and regions. The third measure was used to enable exploration and explanation of differences between and within the groups of pupils. This measure, however, cannot be interpreted directly in terms of the skills or the preparation to independently enter the community or secondary education, but it does enable many new analyses to be carried out to identify where differences exist and to use other variables to explain those differences. The test scores were converted to a scale with a mean of 500 and a standard deviation of 100, now widely used as a generic scale in national and international studies. They are described here as 500 scores and they too have been examined at regional and provincial levels and by school location. In summary, the situation was, as expected, the same as for the competency and benchmark presentation: the lowest scores were found in the isolated school locations and the highest in the urban areas. Pupils from the Mekong Delta and North West had the lowest scores.

At the Provincial Level

If statistically significant differences were to be used in the comparison of means, then many of the differences would appear to be significant. This was because the sample was very large so that even slight differences between groups would appear to be statistically significant. The project team and MOET considered that, when mean scores were being compared, it would be advisable to ensure that a difference of the means would constitute an equivalent of 0.20 of a standard deviation or 20 points in the 500 scale. Thus differences have been reported in terms of 0.20 of a standard deviation. This is shown for pairwise comparisons of provinces in Figure 2.

Reading down a column and across a row enables a comparison of every region with every other region in a series of pair wise comparisons. The symbol '●' indicates that there is no educationally important difference between the provincial means in that column and row. The arrow symbol '▲' points to the region with the higher score and hence the table shows that the regions at the top of the left hand column. An important interpretation of these data is based on the spread of the 'dots' ('●') throughout the figure. If the dots cover the entire figure it could be concluded that there was an equitable spread of achievement across regions. If the dots formed a thin line across the diagonal, there would be evidence of serious discrepancy between regions.

It can be seen that there were no important differences in mathematics scores among the provinces from Quang Ninh to Hung Yen. Overall, the figure can show how equitable the system is in terms of achievement. If the middle band with the dots covered the whole chart, the system would be seen to be equitable. The thinner that shaded region in the middle band is, the more inequitable are the achievement levels.

The narrowness of the middle band of comparisons indicated that, on the whole, the differences in achievement represented a high level of inequity of achievement in the

Figure 1

Figure2

school system. The narrowing of the middle band at the top of the distribution suggested that there were few high achieving provinces and then a skewed distribution illustrating a few ‘elite’ provinces and then a further skew towards a majority of lower performing provinces.

The '500' scores by school location are presented in Figure 4. There is a clear and consistent relationship between mathematics achievement and school location. Pupils in isolated areas tended to achieve lower scores than pupils in urban areas in all regions. This was especially marked in the North West, Central Coast and the Mekong Delta, where the mean scores of pupils in isolated schools were low. In the Mekong Delta, pupils in both isolated and rural areas had low scores in mathematics.

Sub-Domain Scores

The mathematics test consisted of three sub-domains: number, measurement and space/data. As shown in Table 6, correlations of scores were consistent across mathematics sub-domains and this suggested that the three scores may have been measuring a single underlying factor. The sub-domains were reported separately to MOET for curriculum analysis and development reasons, but for explanations and exploration of differences among sub-groups of the sample it is appropriate to treat the sub-domains as a single entity.

While it is important for curriculum specialists to understand the details of performance within each sub-domain, the explanation of differences in achievement for the purposes of intervention focuses on the overall achievement in mathematics, and the evidence of a single underlying dimension strengthens the argument for the generalised interpretation of the benchmark performances. In mathematics, differences among sub-domain scores were not significant. The major issues for mathematics development appear to be in the links between isolation and achievement.

Gender and Socioeconomic Predictors

The MOET wanted to have information on pupil achievement differences between boys and girls and between different socioeconomic groups.

Socioeconomic Groups

In Vietnam, the socioeconomic group definition was developed using a range of family background factors (see Griffin, 2005; Postlethwaite 2005). The variables making up the construct of home background were ‘possessions in the home’, ‘parental education’, ‘pupil ethnic affiliation’, ‘pupil speaking Vietnamese outside school’, and ‘number of books in the home’. Each pupil received a weighted factor score for ‘home background.’ These were arranged in ascending order and split into four groups such that there were about equal numbers of pupils in each group.

In the group of socioeconomic status (SES) Level 1, 54% of pupils came from ethnic minority groups. They had parents who had an average of 9.4 years of education, no more than five books in the home, and seven items from a list of possessions at home. In this group, 14% of pupils never spoke Vietnamese and 30% of pupils sometimes spoke Vietnamese outside school. In the group of SES Level 2, only 1% of pupils came from an ethnic minority. They had parents who averaged 12.8 years of education, no more than five books, and nine possessions at home. In this group, all of the pupils always spoke Vietnamese outside school. In the group of SES Level 3, all pupils came from the Kinh ethnic group and always spoke Vietnamese. They had parents who had 16.4 years of education, an average of 11 books at home, and 10 items at home. In the group of SES Level 4, all pupils came from the Kinh ethnic group and always spoke Vietnamese. They had parents who typically had 21.9 years of education, an average of 35 books and 13 items from a list of possessions at home.

The mean scores in mathematics by region and by socioeconomic levels are presented in Figure 4. In mathematics, pupils from higher socioeconomic groups achieved higher scores than pupils from lower socioeconomic groups in any region. The relationship between family background and achievement was clear. Pupils from poorer families had lower levels of achievement. The link between isolation, poverty and achievement was also clear.

There were important differences between socioeconomic groups and the differences were educationally important within and between regions. The pupils in the lowest socioeconomic group on average never reached the achievement levels of the pupils in the highest socioeconomic group regardless of region. In other words, poverty was not overcome in educational terms, no matter where the pupils lived and the link between poverty and achievement was clear.

While this discussion emphasises the relationship of achievement and socioeconomic status it offers little solace to policy makers if there are no strategies to reduce the variance

Table 6

Figure 3

Figure 4

Figure 5

Figure 6

in SES, and hence reduce variance in achievement, assuming there is a causal relationship. It is also true that while SES is difficult to control, it might be possible to reduce the effects on achievement if other malleable variables can be linked to achievement. It is possible that teacher expertise and effectiveness can be manipulated. The argument for such a causal relationship is easier to make because an almost linear relationship has been demonstrated in Vietnam between teacher skill and student achievement at a provincial level (Griffin, 2007). It mattered where students were educated and it mattered who taught them. The combined influence of SES and teacher skills in mathematics further underlined the importance of location, socioeconomic status and teacher skill as contributing factors to variance in student achievement.

Extreme Performances

The upper 5% of pupils were identified by separating all pupils above the 95th percentile. The lower 5% were identified as those below the 5th percentile. The percentages of pupils were then tabulated for those who had scored high enough to be in the national top 5% of pupils in each region by school location and by socioeconomic levels. The results of this analysis are presented in Table 7. For example, of the pupils in isolated schools in the Red River Delta, 0.6% achieved high enough scores to be in the national upper 5%. It can also be seen that 7.6% of the rural school pupils and 13.9% of the urban school pupils in the Red River Delta were identified as being in the national upper 5% of pupils in mathematics achievement. This can be compared with pupils in isolated schools in the Mekong Delta, of whom only 0.4% achieved high enough scores to be in the national upper 5% of pupils, in comparison with 0.97% of pupils in rural schools, and 3.2% of pupils in urban schools. It is clear that pupils in urban areas were more likely to be in the top 5% of pupils.

It is also evident that there was a relationship between economic advantage and higher achievement. The trend across regions was consistent. As socioeconomic status increased, the representation of the upper 5% of pupils in terms of mathematics achievement increased. In the Red River Delta, 2.7% of the pupils in the lowest socioeconomic background (or from the poorer homes) were in the upper 5% of mathematics achievers. This contrasted with 14.8% of pupils from the most advantaged home background. This pattern was repeated across all regions. Similarly, in urban areas pupils achieved at a higher level than those in isolated areas regardless of the region or province in which they lived.

In Table 8, the percentages of pupils in the lowest 5% of all Vietnamese pupils in mathematics are presented. In the lowest 5% of all achievers, pupils from isolated schools

Table 7

Table 8

dominated and urban schools had low representation. In terms of socioeconomic level, pupils from poorer home backgrounds were over-represented in the lowest 5% of achievers.

Summary and Conclusions

This paper has dealt with the mathematics of Grade 5 pupils in Vietnam. First, the percentages of pupils at different skill levels were examined. This was followed by a review of the percentages of pupils who could be said to be a) pre-functional, b) able to cope with daily demands of Vietnamese society, and c) of sufficient standard to be able to learn independently in Grade 6. Subsequently, a comparison was made between various sub-groups of pupils on their total scores scaled to a mean of 500 and a standard deviation of 100. The national upper 5% and the lower 5% of pupils were analysed by school location and by socioeconomic levels within each region.

Of particular concern were the pupils in isolated schools with low socioeconomic backgrounds. They had low scores and were more likely to be functional in mathematics but not yet to possess mathematics skills deemed necessary for independent learning in Grade 6. The pupils from the lower socioeconomic levels also appeared to require special

support. On the other hand, the analysis has shown that there were no significant gender-related differences in achievement.

The major question for the Government of Vietnam at both the central and provincial level focuses on what can be done about the low achieving pupils. The MOET might wish to consider, for example, the introduction of curriculum and assessment frameworks and benchmarks written in criterion-referenced (profile) format. This can be done as the new curriculum is introduced. This could encourage a competency-based developmental interpretation of pupil performances. It may also be necessary to establish developmental assessment procedures to plan intervention programs for specific groups of pupils and teachers. The issues needing attention are in lower socioeconomic and isolated locations and the Government has launched programs to deal with the impact of isolation. Special attention is required to address these joint influences on achievement.

Many other countries have also introduced performance-monitoring programs and the MOET might consider such a system at both province and district level in which school, district and province level performances are monitored against competency levels and benchmarks. In order to achieve this, however, there would be a need for an expansive program of training for district and provincial officers in techniques for monitoring and intervention against competency levels and benchmarks.

At the same time, it may have become necessary for the MOET to consider accelerating the shift in the primary school mathematics curriculum to ensure that more pupils are adequately prepared for the wider range of genre encountered in secondary school learning materials. This needs to be coupled with urgent action for schools in low performing regions where isolation and poverty combine to align with low competency levels.

Notes

1. A detailed technical explanation of how and why this was done has been given in Volume 3 of Postlethwaite (2005). The experts made two ratings for each item in the tests. The first was the probability that a person who could adequately function in Vietnamese society could obtain the correct answer to each item. The second was the probability that a pupil who had adequate skills to cope with Grade 6 learning, could obtain the correct answer to each item. In each case the probabilities were summed using an Angoff (1971) approach to establish the cut-off points.

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Table 1
Percentages of Pupils Reaching the Different Skill Levels in Mathematics

	Mathematics Skill Levels	Percent	SE
Level 1	Reads, writes and compares natural numbers, fractions and decimals. Uses single operations of +,-,x and : on simple whole numbers; works with simple measures such as time; recognises simple 3D shapes.	0.2	0.02
Level 2	Converts fractions with denominator of 10 to decimals. Calculates with whole numbers using one operation (x,-,+ or ÷) in a one-step word problem; recognises 2D and 3D shapes.	3.5	0.13
Level 3	Identifies place value; determines the value of a simple number sentence; understands equivalent fractions; adds and subtracts simple fractions; carries out multiple operations in correct order; converts and estimates common and familiar measurement units in solving problems.	11.5	0.27
Level 4	Reads, writes and compares larger numbers; solves problems involving calendars and currency, area and volume; uses charts and tables for estimation; solves inequalities; transformations with 3D figures; knowledge of angles in regular figures; understands simple transformations with 2D and 3D shapes.	28.2	0.37
Level 5	Calculates with multiple and varied operations; recognises rules and patterns in number sequences; calculates the perimeter and area of irregular shapes; measurement of irregular objects; recognises transformed figures after reflection; solves problems with multiple operations involving measurement units, percentage and averages.	29.7	0.41
Level 6	Problem solving with periods of time, length, area and volume, embedded and dependent number patterns; develops formulae; recognises 3D figures after rotation and reflection and embedded figures and right angles in irregular shapes, data from graphs and tables.	27	0.6

Table 2

Percentages and Sampling Errors of Pupils at Each Skill Level in Mathematics by Region

Region	Mathematics Skill Level											
	Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
	%	SE	%	SE	%	SE	%	SE	%	SE	%	SE
Red River Delta	0.10	0.02	2.00	0.25	7.20	0.45	22.40	0.87	30.60	0.92	37.80	1.75
Northeast	0.20	0.04	4.40	0.34	12.20	0.52	24.90	0.84	26.00	1.00	32.30	1.34
Northwest	0.80	0.28	8.30	1.37	13.30	1.39	24.00	2.12	24.60	2.22	28.90	3.07
North Central	0.10	0.11	2.20	0.36	7.60	0.69	24.30	1.36	33.20	1.46	32.60	2.32
Central Coast	0.00	0.02	2.20	0.31	10.10	0.68	30.50	1.12	34.20	1.01	22.9	1.60
Central Highlands	0.30	0.15	2.90	0.54	9.20	1.21	24.50	1.84	32.60	2.18	30.50	3.10
Southeast	0.10	0.03	2.50	0.23	10.20	0.59	31.20	1.04	33.80	0.97	22.20	1.48
Mekong Delta	0.20	0.04	5.80	0.32	19.60	0.68	37.30	0.83	24.10	0.90	13.00	0.93
Vietnam	0.20	0.02	3.50	0.13	11.50	0.27	28.20	0.37	29.70	0.41	27.00	0.60

Table 3

Percentages and Sampling Errors of Pupils at Different Skill Levels in Mathematics by School Location

Region	Area	Math Skill Levels (pupil)											
		Level 1		Level 2		Level 3		Level 4		Level 5		Level 6	
		%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*	%	*SE*
Red River Delta	Isolated	.	.	1.50	na	9.30	na	35.50	na	na	na	32.50	na
	Rural	0.10	0.03	2.40	0.30	8.20	0.58	24.70	1.02	30.90	1.04	33.70	1.94
	Urban	0.10	0.06	0.30	0.12	2.30	0.46	10.50	1.15	29.90	1.82	57.10	2.40
	Total	0.10	0.02	2.00	0.25	7.20	0.45	22.40	0.87	30.60	0.92	37.80	1.75
Northeast	Isolated	0.40	0.17	8.40	1.34	18.10	1.73	28.90	2.14	22.50	2.53	21.80	3.47
	Rural	0.20	0.05	4.30	0.40	12.40	0.69	25.90	1.18	25.90	1.19	31.4	1.71
	Urban	0.00	0.02	1.00	0.27	5.20	0.92	17.00	1.97	30.30	2.39	46.40	3.82
	Total	0.20	0.04	4.40	0.34	12.20	0.52	24.90	0.84	26.00	1.00	32.30	1.34
Northwest	Isolated	2.00	0.74	12.90	3.13	16.60	2.81	25.00	3.75	23.10	4.35	20.50	4.94
	Rural	0.30	0.17	6.90	1.65	13.30	1.70	24.10	2.75	22.90	2.79	32.60	4.49
	Urban	.	.	2.60	1.09	5.70	1.31	21.20	3.99	34.30	3.59	36.20	4.96
	Total	0.80	0.28	8.30	1.37	13.30	1.39	24.00	2.12	24.60	2.22	28.90	3.07
North Central	Isolated	.	.	2.90	1.20	11.80	2.85	21.40	4.36	30.40	4.54	33.40	6.94
	Rural	0.20	0.14	2.20	0.45	7.70	0.82	25.60	1.64	33.1	1.68	31.20	2.82
	Urban	0.00	0.04	1.50	0.75	4.20	1.61	18.90	2.22	35.60	2.90	39.90	4.55
	Total	0.10	0.11	2.20	0.36	7.60	0.68	24.20	1.36	33.20	1.46	32.70	2.32
Central Coast	Isolated	.	.	4.90	1.66	18.00	3.12	33.50	3.070	32.00	3.49	11.70	2.77
	Rural	0.00	0.03	2.10	0.35	10.30	0.85	34.30	1.32	33.60	1.32	19.70	1.75
	Urban	.	.	1.00	0.31	5.60	0.96	19.70	1.74	37.10	1.83	36.70	3.29
	Total	0.00	0.02	2.20	0.30	10.00	0.69	30.50	1.13	34.30	1.01	23.00	1.60
Central Highlands	Isolated	0.70	0.31	5.90	1.75	13.10	2.78	28.60	4.84	28.20	3.92	23.60	6.36
	Rural	0.30	0.25	2.50	0.69	10.60	2.06	24.90	2.75	32.10	3.46	29.60	5.01
	Urban	0.20	0.18	1.20	0.44	3.40	0.68	20.60	2.63	37.20	3.22	37.50	5.18
	Total	0.30	0.15	2.90	0.54	9.20	1.21	24.50	1.84	32.60	2.18	30.50	3.10
Southeast	Isolated	0.10	0.07	3.90	0.99	15.60	2.00	38.7	2.30	25.90	2.37	15.80	3.17
	Rural	0.1	0.05	3.70	0.42	13.70	0.96	37.20	1.31	30.90	1.13	14.40	1.86
	Urban	.	.	0.90	0.23	4.70	0.60	22.2	1.44	39.20	1.71	33.00	2.21
	Total	0.10	0.03	2.60	0.23	10.20	0.59	31.20	1.04	33.70	0.96	22.30	1.48
Mekong Delta	Isolated	0.40	0.18	7.00	1.11	21.00	1.63	40.60	2.50	22.00	2.92	9.00	2.15
	Rural	0.20	0.04	6.30	0.35	21.40	0.80	38.20	1.00	23.60	0.91	10.50	0.91
	Urban	.	.	2.90	0.67	11.30	1.36	31.10	2.42	28.00	1.71	26.70	3.26
	Total	0.20	0.04	5.80	0.32	19.60	0.68	37.30	0.83	24.10	0.90	13.00	0.93
Vietnam	Isolated	0.40	0.09	6.40	0.56	17.00	0.82	32.60	1.38	25.20	1.36	18.50	1.69
	Rural	0.10	0.03	3.60	0.15	12.40	0.33	29.80	0.47	29.10	0.51	25.00	0.75
	Urban	0.00	0.02	1.30	0.15	5.40	0.43	20.60	0.67	34.20	0.80	38.50	1.12
	Total	0.20	0.02	3.50	0.13	11.50	0.27	28.20	0.37	29.70	0.41	27.10	0.60

Table 4

Percentages and Standard Errors of Pupils at Each Benchmark by Region and School Location

REGION	Location	Mathematics					
		Pre Functional		Functional		Independent	
		%	*SE*	%	*SE*	%	*SE*
Red River Delta	Isolated	0.70	1.00	21.00	8.00	78.40	8.48
	Rural	2.00	0.3	13.00	0.80	85.20	1.00
	Urban	0.40	0.20	3.20	0.60	96.40	0.67
	Total	1.70	0.20	11.00	0.70	87.10	0.83
Northeast	Isolated	7.20	1.30	27.00	2.30	66.20	3.03
	Rural	3.30	0.40	18.00	1.00	78.30	1.18
	Urban	0.90	0.20	7.90	1.30	91.20	1.43
	Total	3.60	0.30	18.00	0.70	78.40	0.88
Northwest	Isolated	13.00	3.40	23.00	3.60	63.90	5.26
	Rural	6.00	1.60	20.00	2.40	74.40	3.37
	Urban	1.80	0.60	9.00	2.00	89.20	2.44
	Total	7.80	1.40	19.00	1.80	72.90	2.72
North Central	Isolated	1.90	1.00	19.00	4.70	79.20	4.99
	Rural	1.80	0.50	12.00	1.20	86.2	1.46
	Urban	1.50	0.80	7.50	2.10	91.00	2.67
	Total	1.80	0.40	12.00	1.00	86.30	1.22
Central Coast	Isolated	3.80	1.40	25.00	3.70	71.00	4.77
	Rural	1.60	0.30	16.00	1.10	82.10	1.14
	Urban	0.70	0.20	8.90	1.20	90.50	1.32
	Total	1.60	0.20	16.00	0.90	82.90	0.96
Central Highlands	Isolated	5.60	1.60	17.00	3.30	77.30	4.37
	Rural	2.60	0.90	16.00	2.70	81.40	3.31
	Urban	1.20	0.50	6.40	1.20	92.40	1.560
	Total	2.90	0.60	14.00	1.60	83.50	2.05
Southeast	Isolated	3.20	0.80	24.00	3.00	72.70	3.50
	Rural	2.70	0.40	21.00	1.30	75.90	1.44
	Urban	0.60	0.20	7.50	0.80	91.90	0.91
	Total	1.90	0.20	16.00	0.80	82.20	0.85
Mekong Delta	Isolated	6.30	1.10	31.00	2.20	63.10	2.68
	Rural	4.80	0.30	31.00	1.00	64.10	1.05
	Urban	2.20	0.60	17.00	1.90	80.70	2.14
	Total	4.60	0.30	29.00	0.90	66.80	0.93
Vietnam	Isolated	5.70	0.50	25.00	1.30	69.40	1.45
	Rural	2.90	0.20	19.00	0.40	78.50	0.48
	Urban	1.00	0.10	8.50	0.50	90.40	0.59
	Total	2.80	0.10	17.00	0.40	79.90	0.41

Table 5

Comparison of Benchmark Scores After Allowing for Old and New Curriculum

			Curriculum					
Item set	all	all	old	new	old	new	old	new
Benchmark	Functional	Independent	Benchmark		Functional		Independent	
Raw score	36.70	20.90	25.00	32.00	15.90	20.80	9.30	12.70
Proportion	0.64	0.37			0.64	0.65	0.37	0.40

Table 6

Correlations Between Sub-Domain Scores of Mathematics

	Number	Measurement	Space/Data
Number	1		
Measurement	0.81	1.00	
Space/Data	0.73	0.80	1.00

Table 7

Percentages of Pupils in the Upper 5% in Mathematics Achievement of all Pupils by School Location and Socioeconomic Level

	Red River Delta	Northeast	Northwest	North Central	Central Coast	Central Highlands	Southeast	Mekong Delta	Vietnam
Location									
Isolated	0.62	3.13	2.84	4.96	1.33	2.51	2.32	0.36	2.26
Rural	7.58	6.31	2.60	4.39	1.67	5.94	1.00	0.97	4.17
Urban	13.92	12.8	7.32	6.59	4.03	5.23	4.34	3.23	6.88
SES									
Level 1	2.70	2.40	2.50	6.40	0.60	1.80	0.80	0.70	2.00
Level 2	4.20	4.50	3.40	3.10	1.30	4.30	0.90	0.80	2.40
Level 3	7.70	8.60	4.40	4.00	1.80	8.20	2.10	0.80	4.80
Level 4	14.8	16.1	11.2	6.2	5.30	7.70	5.80	4.00	9.20

Table 8

Percentages of Pupils in the Lowest 5% of all Pupils in Mathematics by School Location and Socioeconomic Level

	Red River Delta	Northeast	Northwest	North Central	Central Coast	Central Highlands	Southeast	Mekong Delta	Vietnam
Location									
Isolated	1.2	11.4	17.5	3.6	6.8	7.4	5.2	9.2	8.5
Rural	3.2	5.8	9.4	2.9	3.1	3.8	4.6	8.7	5.0
Urban	0.4	1.4	3.5	1.6	1.3	1.6	1.1	4.0	1.7
SES									
Level 1	7.2	11.0	13.4	6.2	7.0	8.8	6.7	12.9	10
Level 2	4.2	5.2	6	3.9	3.2	1.5	3.4	7.1	4.7
Level 3	2.4	2.4	4.4	1.6	2.3	2.0	2.2	5.0	2.7
Level 4	0.8	0.8	2.6	1.6	1.2	1.3	0.8	3.2	1.3

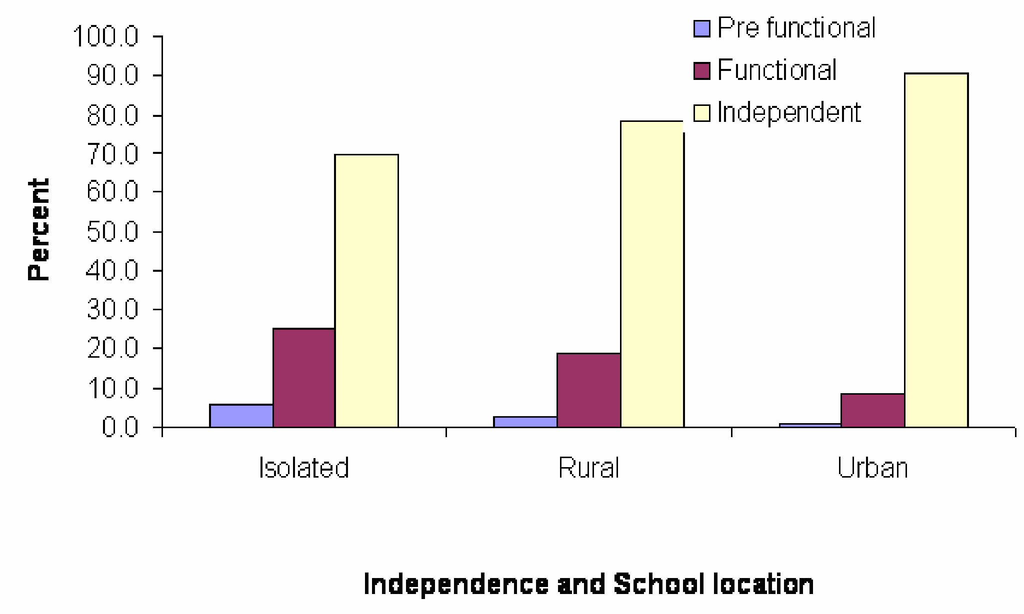

Figure 1. Relationship between school location and functionality level of achievement.

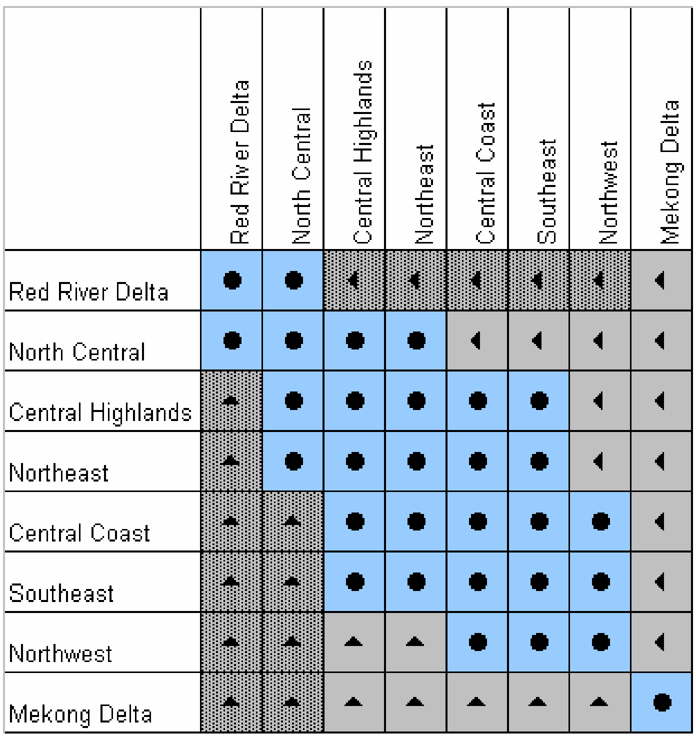

Figure 2. Total scores in mathematics by region.

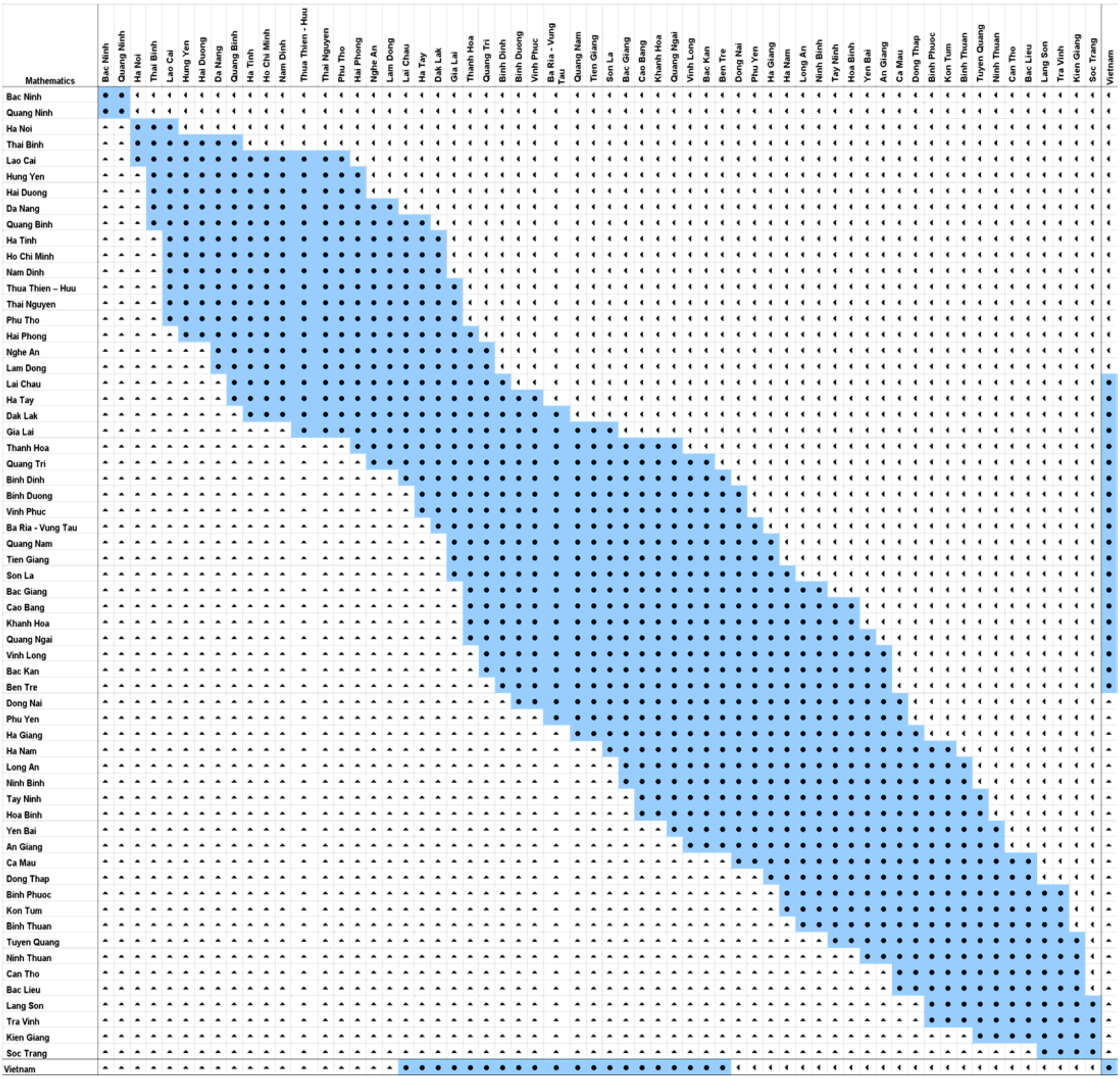

Figure 3. Pair wise comparisons of provincial mathematics scores.

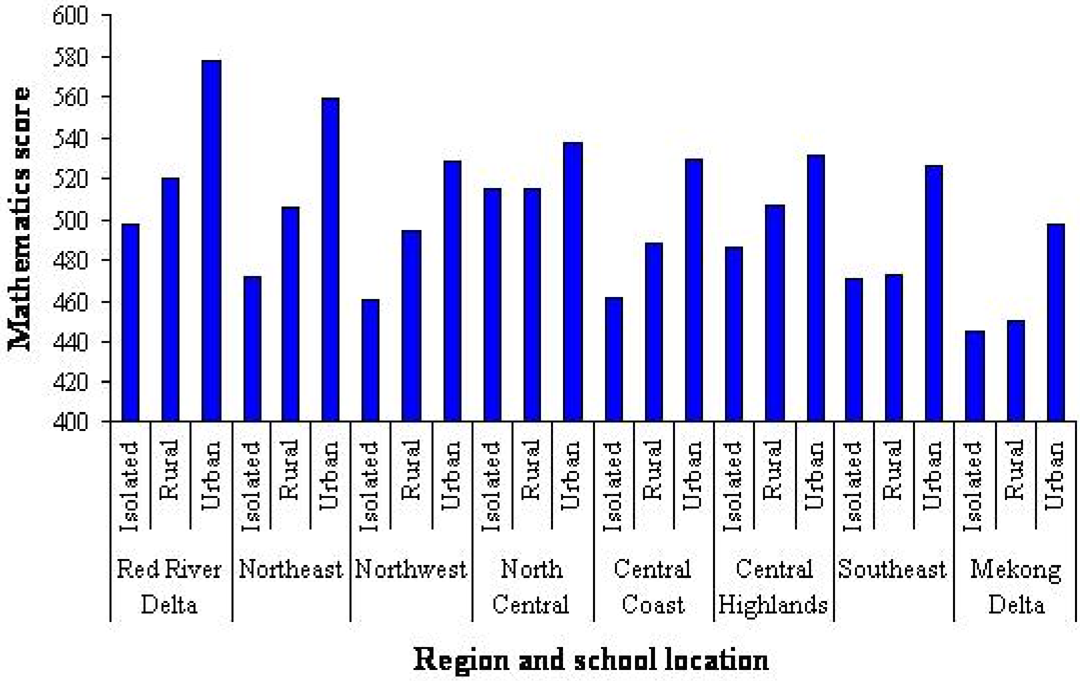

Figure 4. Location within region and relationship to pupil mathematics achievement

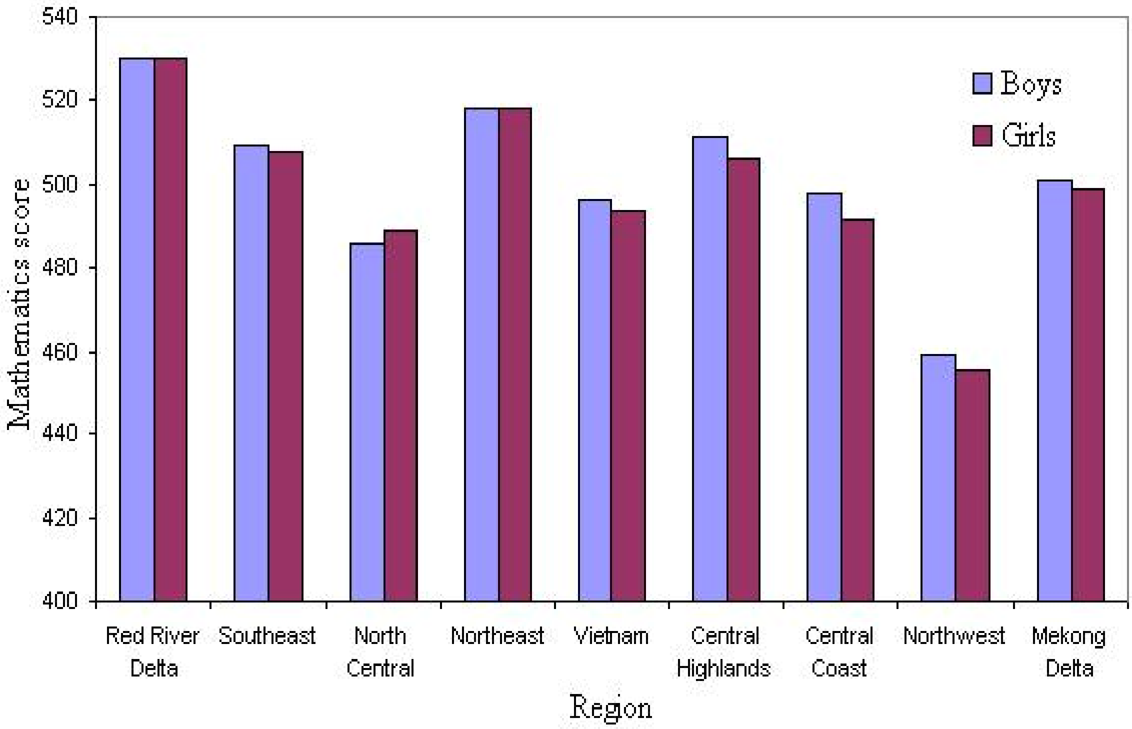

Figure 5. Boys and girls' mean mathematics scores by region.

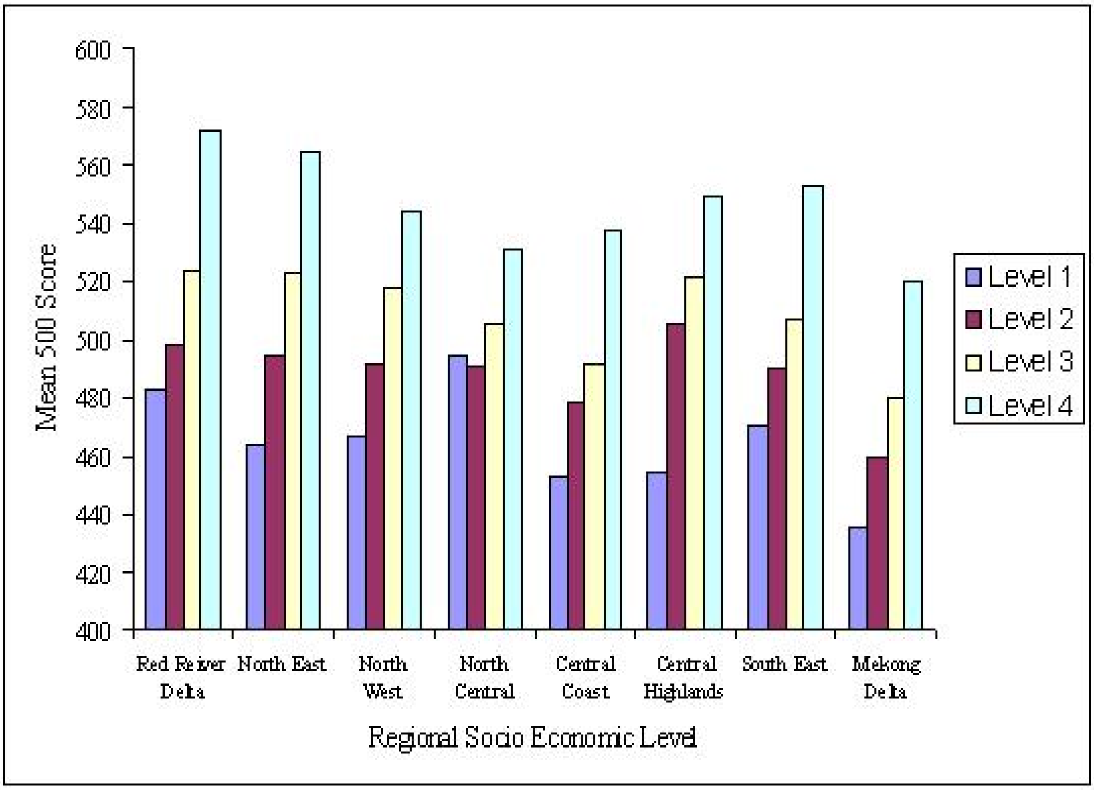

Figure 6. Pupil mathematics scores for regions by socio-economic levels (1-4)